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Original Research Article

Removal of Acetic Acid from Wastewater by Groundnut Shell and Coconut Shell Adsorbents

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ABSTRACT

Low cost adsorbents derived from waste materials are being explored as starting materials for removal of various pollutants from wastewater. Simple and easy operation and flexibility in terms of adsorbents and contacting equipments are key features of adsorptive removal of pollutants. Acetic acid is one such pollutant occurring in the effluent from petroleum, refineries, pharmaceutical and many other industries. The removal of acetic acid can be carried out by various treatment methods. Adsorption is one such method used for acetic acid removal from wastewater. The present investigation explores the possibility of removal of acetic acid from effluent by using low cost adsorbents prepared from groundnut and coconut shells.

Key words: Activation, adsorbent dose, pH, contact time, concentration.

INTRODUCTION

Wastewater treatment for removal of various pollutants can be carried out by various physical, chemical and biological methods. The treatment methods are also classified as primary, secondary and tertiary treatments. In primary treatment, the coarser particles, solids are removed by using bar screens. In secondary treatment, biological treatments are used. These are classified as attached growth and suspended growth. Activated sludge process is widely used suspended growth methods. It is used for removal of organic matter. [1-3] Trickling filter system is attached growth biological treatment used for removal of organic pollutants. Also advance oxidation method can be used for removal of organic matter. [4-6] These treatments are also tried for removal of heavy metals and other organic and inorganic pollutants. [7-9] Acetic acid is one of the important pollutants emitted from the effluent of petroleum, fine chemical, pharmaceutical and textile industry. Various investigators have carried out studies on removal of acetic acid by biological and physical treatment methods. [10-13] Adsorption by using various low cost adsorbent was also carried out by different investigators. In the present investigation, groundnut shell adsorbent (GNSA), coconut shell adsorbent (CSA) are used for acetic acid removal from synthetic wastewater.

METHODOLOGY

Preparation of adsorbents

Groundnut shell is available as carbonaceous solid waste from oil processing mills. Groundnut shells are low cost and locally available agricultural waste. Therefore these are used as raw materials for adsorbent. These have the advantages of greater percentage of non-carbon constituents in their composition compared to coal or peat. Coconut shell activated carbon exhibits good adsorption

characteristics and can be used as a low cost adsorbent for pollutants removal from waste water. One of the main advantages of using coconut shell adsorbent (CSA) over the other chemical treatment methods is its abundance and easy availability. It makes them a strong choice in the investigation for economical COD removal. The raw material was dried and kept in muffle furnace at 150^{O}C for 3 hours. Then it was crushed, washed. It was treated with dilute hydrochloric acid and then dilute sodium hydroxide. Also zinc chloride activation was carried out. Finally material was washed, dried and heated to high (150-180^{O}C) before using for experiments.

Fig 1: Groundnut shells

Fig 2: Coconut shells

Fig 3: GNSA Adsorbent

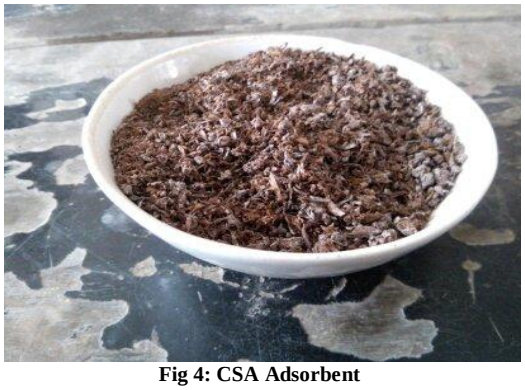

Fig 4: CSA Adsorbent

Batch Experiments were carried out in 250 ml conical flask to study the percentage removal and effect of various parameters like contact time, adsorbent dose, initial concentration and pH. The synthetic effluent was brought in contact with adsorbent in conical flask for the required contact time. Then it was filtered. The filtrate was analyzed for acetic acid concentration by titration method.

RESULTS AND DISCUSSIONS

Table 1 shows effect of initial concentration on % acetic acid (AA) reduction. There was no systematic trend observed. With initial concentration for GNSA, the % removal showed increase followed by decrease. For CSA, it showed increase upto 0.21 N and then the increase was insignificant. The irregularities in the trends can be attributed to deficiencies in filtration and stirring. As shown in table 2, with contact time, the adsorption increased. The optimum contact time was 70 minutes for GNSA and 80 minutes for CSA. For both the adsorbents, the increase in percentage adsorption was observed with adsorbent dose, as shown in table3. 5 grams per 100 was optimum dose for both, but GNSA showed 44 % removal compared to CSA (22 %). The optimum pH was observed to be 8. The pH vs percent removal is shown in table 4.

Table 1: Data of initial concentration VS % reduction

Initial concentration (N)	Percentage reduction for GNSA	Percentage reduction for CSA
0.0525	12.16	13.6
0.105	6.711	8.5
0.1575	12.227	9.8
0.21	9.345	12.5
0.2625	10.406	12.3

Table 2: Time VS % reduction

Time (min)	Percentage reduction for GNSA	Percentage reduction for CSA
20	6.345	1.545
40	9.137	3.090
70	10.40	5.9602
80	10.40	12.362

Table 3: Adsorbent dose VS %reduction

Adsorbent dose (gm)	Percentage reduction for GNSA	Percentage reduction for CSA
1	12.162	10.4
2	29.72	14.9
3	41.89	15.72
4	39.189	18.12
5	44.59	22.97

Table 4: pH Vs % reduction

pH	Percentage reduction for GNSA	Percentage reduction for CSA
4	25.01	21.2
5	27.3	22.4
6	27.7	23.3
7	27.9	24.5
8	28.2	25.2

CONCLUSION

The result obtained for low cost adsorbents obtained from agricultural raw material are encouraging. The GNSA appears to be better with 45 percent removal. Better activation process and use of more sophisticated equipments can increase the percentage removal. The operating parameters like contact time, initial concentration, adsorbent dose and pH affect the percentage adsorption.

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